THE CLAIMS

1. A method of sensing molecules, the method comprising:
exposing a surface of a semiconductor to the molecules; and
sensing a change in surface photovoltage of the semiconductor.

2. The method of claim 1, wherein the change in surface photovoltage is sensed to determine molecule identity.

3. The method of claim 1, wherein the change in surface photovoltage is sensed to determine molecule quantity.

4. The method of claim 1, further comprising illuminating the exposed semiconductor surface while sensing the change in surface photovoltage.

5. The method of claim 4, wherein the semiconductor has a bandgap, and wherein the surface is illuminated with light of photon energy greater than or equal to the semiconductor bandgap.

6. The method of claim 4, further comprising illuminating the exposed surface with additional illumination having a wavelength that enhances interaction between a specific type of molecule and the exposed surface, whereby the sensed surface photovoltage determines the presence of the specific type among the molecules being sensed.

7. The method of claim 1, further comprising enhancing interaction between a specific type of molecule and the exposed surface.

8. The method of claim 7, wherein a functional coating is used to enhance the interaction.

9. The method of claim 7, wherein the interaction is enhanced by selection of material for the semiconductor.

10. The method of claim 1, wherein the sensing includes generating an electrical signal related to the change in surface photovoltage.

11. The method of claim 10, wherein generating the signal includes using a light transparent electrode in contact with the exposed surface, the electrode partially covering the surface.

12. The method of claim 10, wherein generating the signal includes using a grid-like electrode in contact with the exposed surface.

13. The method of claim 10, wherein the sensing includes using an electrode that is capacitively coupled to the semiconductor and that does not make contact with the exposed surface, the electrode not interfering with the interaction of molecules at the surface; and measuring capacitance between the electrode and the semiconductor.

14. The method of claim 10, further comprising illuminating the surface with an ac light probe and creating an electrical ac reference; and wherein the sensing includes enhancing the signal at the frequency corresponding to the ac reference.

15. The method of claim 1, further comprising refreshing the surface of the semiconductor after the surface photovoltage is sensed.

16. A molecule sensor comprising:
a semiconductor having a sensing surface; and
a circuit for sensing a change in surface photovoltage of the semiconductor.

17. The sensor of claim 16, further comprising a light source for illuminating the sensing surface with light of photon energy greater than or equal to semiconductor bandgap.

18. The sensor of claim 17, further comprising a second light source for illuminating the sensing surface with additional illumination having a wavelength that enhances interaction between a specific type of molecule and the sensing surface.

19. The sensor of claim 16, further comprising means for enhancing interaction between a specific type of molecule and the sensing surface.

20. The sensor of claim 16, further comprising a functional coating on the sensing surface.

21. The sensor of claim 20, wherein the functional coating includes functionalized biomolecules immobilized on the sensing surface.

22. The sensor of claim 20, wherein the functional coating includes single strand DNA immobilized on the sensing surface.

23. The sensor of claim 16, wherein material for the semiconductor enhances interaction between a specific type of molecule and the sensing surface.

24. The sensor of claim 16, further comprising an electrode in electrical communication with the sensing surface and the circuit.

25. The sensor of claim 24, wherein the electrode is light transparent and in contact with the sensing surface, the electrode partially covering the surface.

26. The sensor of claim 24, wherein the electrode is grid-like and in contact with the sensing surface.

27. The sensor of claim 24, wherein the electrode is spaced apart from and capacitively coupled to the semiconductor, the electrode not interfering with the interaction of molecules at the sensing surface; the circuit measuring capacitance between the electrode and the semiconductor.

28. The sensor of claim 16, further comprising a source for illuminating the surface with an ac light probe; the circuit creating an electrical ac reference and enhancing the signal at the frequency corresponding to the ac reference.

29. The sensor of claim 16, further comprising means for refreshing the sensing surface after the surface photovoltage is sensed.

30. The sensor of claim 16, further comprising a source for illuminating the sensing surface with ultraviolet radiation after the change in surface photovoltage is sensed.

31. The sensor of claim 16, further comprising a heating element coupled to a reference surface of the semiconductor for heating the semiconductor.

32. The sensor of claim 16, further comprising a source for providing a species-removing fluid over the sensing surface after the change in surface photovoltage is sensed.

33. A system for detecting molecules, the system comprising:

a plurality of sensors, each sensor including a semiconductor having a sensing surface;

at least one light source for illuminating the sensing surfaces of the sensors; and

a circuit for sensing a change in surface photovoltage of the semiconductors while the sensing surfaces exposed to the molecules.

34. The system of claim 33, wherein at least some of the sensors are sensitive to different types of molecules.

35. The system of claim 33, wherein at least some of the sensors have different sensitivities to the same type of molecule.

36. The system of claim 33, further comprising optics for directing the illumination onto the sensing surfaces.

37. The system of claim 33, wherein the circuitry is formed in the semiconductor whereby the system is monolithic.

38. The system of claim 33, wherein the semiconductor and circuit are separate, whereby the system is a hybrid.

39. The system of claim 33, wherein the light source provides light of photon energy greater than or equal to semiconductor bandgaps of the sensors.

40. The system of claim 33, further comprising means for enhancing interaction between at least one specific type of molecule and the sensing surfaces of the sensors.

41. The system of claim 33, further comprising electrode means in electrical communication with the circuit and the sensing surfaces of the sensors.

42. The system of claim 33, further comprising means for refreshing the sensing surfaces of the sensors.